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TEN YEARS' EXPERIENCE IN TRAINING GEOLOGISTS AND GEOLOGY ENGINEERS FROM THE UNDERDEVELOPED AREAS

By Dr. H. PUTZER,
Geological Survey
of the Federal Republic of Germany,
Hanover

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TEN YEARS' EXPERIENCE TRAINING GEOLOGISTS AND GEOLOGY ENGINEERS FROM THE UNDER DEVELOPED AREAS

DR. H. PUTZER, GEOLOGICAL SURVEY OF THE FEDERAL REPUBLIC OF GERMANY, HANOVER

It is considered necessary that scientific personnel engaged with Governmental Geological Surveys should receive, in addition to their University studies, training in working techniques which are required by such scientific institutions. The Federal Republic of Germany has arranged for the training of geologists, geophysicists and technical engineers from countries in the process of development, under the scheme of Governmental scholarships. It is the aim of this training to enable geo-scientists and technical personnel from less developed countries to serve their countries later on, after several years of close cooperation with experienced fellow scientists, by applying geo-scientific working methods for the benefit of economic development.

The instruction and training by the Bundesanstalt für Bodenforschung is given in the Federal Republic of Germany as well as in the countries concerned.

In the Bundesanstalt training, of a few months' up to two years' duration, is given to trainees with professional experience (senior level), to scholars of international organisations and to University graduates (junior level). In addition foreign students are trained during University vacations.

In less developed countries counterparts for the Geological Missions established by the Federal Republic for several years in Afghanistan, Bolivia, Jordan, Tanganyika etc., and also with the working teams commissioned by the Federal Republic to many other countries, have to be trained.

In most cases, the Bundesanstalt cannot influence the selection of foreign scientists; this is done by the competent Ministry of the country concerned. Sometimes the heads of the Geological Mission are asked to cooperate in the selection.

It was found that the graduates of foreign Universities had a very variable level of training. Some of them have received their education exclusively in their own country, whereas others had been to Universities abroad for the whole or part of their time. Scholars coming from countries who have recently gained their independence, are normally the first generation of their people confronted with the problem of using their own initiative in converting scientific and technical knowledge into practical and productive work. It is a general experience that in most cases the training received in less developed countries just comprises theoretical knowledge. Practical experience is lacking almost entirely.

It is the objective to train the scholars in the Bundesanstalt für Bodenforschung especially in economic geology. Prior to their studies in the Bundesanstalt it is considered imperative for the students to pass a two months' course in the German language in a "Goethe-Institut", for the purpose of acquiring the necessary capacity to understand their future work, such as reading appertaining data, setting up reports etc. Following this, the students receive

the same training as the German junior officials in the individual geological departments of the Bundesanstalt für Bodenforschung.

In view of the fact that the Geological Map is fundamental for all problems in applied geology, one of the main objectives is to study Geological Mapping. For this purpose, the students accompany experienced geologists in the field and learn, from the start, to observe rock limits, strike and inclination of beds, to identify the different structures, to describe outcrops, to record profiles, to interpret aerial photos, to use manual drilling equipment, to make entries into maps and to design the final map.

Owing to the fact that in less developed countries the opening of traffic, the utilization of underground and surface waters and a better use of the soil are of particular importance for economic evolution, the students in the Department of Engineering Geology are introduced into the techniques of site investigations for road- and railroad construction, of the footing of bridge piles, of removal of rock slides, of porosity, water content and density determinations. They get acquainted with the problems of stability and impermeability in dam construction.

The main object of training in Hydrogeology is the study of the groundwater balance, the recognition of impervious and damming beds and the permeability of rocks in catchment areas. Simple analyses for determining water quality as also the determination of the capacity of wells are further topics in training. Much attention is given to letting the students have the chance to gather experience in applying geochemical and geophysical techniques (geoelectrics, seismics, geothermics) in the search for groundwater.

In Soil Science the students acquire ample knowledge in the recording and description of soil sections, in producing soil maps and in applying soil-chemical and soil-physical methods, to enable them to identify soil structure and permeability, in projects of irrigation, and the pH-value and chemical composition of the soil which is so important for agriculture and forestry.

During the training in the Science of Mineral Deposits they learn o prospection methods, geochemical tests, sampling and calculating reserves. They are introduced into the method of sample dressing, in making slides and in microscopic analysis. Besides inspecting ore deposits, they are instructed in mines and open pits with respect to the geological mapping of ore veins and salt deposits. In oil-geology they become acquainted, in the field, with the different types of deposits, working procedure in deep drillings and practice in the elaboration of structural maps.

Students in Geophysics get their training in the field at seismic and gravimetric investigations of oilfields, and they are given the essential information in the laboratory regarding the interpretation of geophysical measurements, inclusive electro-logs, and the handling of the different geophysical equipment. They are instructed in the application of the various techniques such as seismic reflection, seismic refraction, magnetics, gravimetry, geoelectrics, radiation measurements etc.

In Paleontology the trainees get acquainted with the guide fossils of the different formations and preparation techniques. In micro-paleontological courses they learn how to deal with preparation and selecting, and they are introduced into the systematology of the zoologic and botanic microfossils important for oil geology.

Further special training is given in our laboratories in spectography, coal

petrography, differential thermo-analyses, radiology and mineralogy.

The training of technical engineers entails the preparation of rock samples for chemical and physical investigations, the preparation of polished and thin sections, grain preparations, the treatment of drilling samples, screen analysis, separation methods in sedimentology, preparation of concentrates of heavy minerals, instruction in the granularity and selection of micro-fossils. During hydrogeological training they are instructed in groundwater measurements, shallow drillings and the preparing of subsoil water maps as well as simple analyses. The Technical engineers are also expected to assist in simple works normally to be carried out in the field, such as drillings, simple profile description, measuring work for geophysical, soil mechanics and mapping work. They learn to tabulate preparations and to use the archives.

The training programme in the geological missions and working groups abroad is entirely dependent on their special problems. During field work, the students have practice in mapping, taking up sections, investigating and sampling deposits. They take part in measurements and interpretations, they are taught how to enter the daily observations into their field diaries and maps, and they are detailed for minor self-directed work. In the surveying of ore deposits they are shown the special mapping of ore bodies and country rocks, they study faults and weathing phenomena and also various prospection methods including the application of aerial photographs and geophysical techniques. The value of teamwork is made evident to them, i.e. the value of close cooperation between different specialists. Importance is attached to their taking part in discussions in the field to make the counterparts accustomed to a critical and objective view.

On their return from the field there follows a training on the evaluation in dressing and specification of samples, drawing of maps, construction of sections and contour maps, calculation of ore reserves and setting up reports. In the intervals where mapping is not done, they attend courses to hear lectures by our geologists concerning methods in mapping, regional, general and historical geology, and seminars on the specification of fossils, minerals, interpretation of maps, hydrogeology and production methods.

People who have never learnt to think independently and to draw their own conclusions, can only very gradually be brought to make a critical elaboration of the given material.

Senior level trainees were, in fact, in a position to deal self-reliantly with the given problems, although occasionally there occurred difficulties in the logical representation.

The Junior level trainees, however, require current supervision and instruction; they nearly always lack the capacity for the self-reliant combination and treatment of scientific problems.

Some of our guests distinguished themselves by their remarkable interest in the profession, others showed clearly the trend for future administration work.

Apart from fundamental training and systematical education for the actual work, one should not neglect to open the students' eyes for the ethical side of the profession. In principle we advocate that the training of junior level geologists should preponderantly take place in their home countries, whereas senior level experts should be given the chance to benefit from a special training in a center of research in industrial countries.

In view of the decisive significance of field work, we attach special importance to the manner of its accomplishment; we have tried to make it clear that profitable work requires full readiness to work under tough conditions in the field.

The professional career of former trainees who now work in their home countries, and the visible success already achieved in this economic evolution have confirmed to us that with our way of training we have entered on the right course.

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